(1044) Computationally Modeling the Role of Bottom-up Attention in Multi-Attribute Choice

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Abstract

Attention has been shown to play a central role in decision-making and multi-alternative multiattribute choice [1, 2, 3]. However, the role of attention has been elusive and characterized in different ways. In this project, we explore the role of attention by manipulating the salience of different options in a multi-alternative, multi-attribute choice display. We include two sets of trials. In one set of trials, there is a dominant option that is better on both attributes than the other alternatives. In the second set, we use attraction effect trials, where a target option dominates a decoy option but not a competitor. We observe that salience interacts with choice, where the salient option is selected more often, especially in quick decisions in both sets of trials. This suggests that salience plays an important role in the dynamics of multiattribute choice. We test different hypotheses for how salience driven attention impacts preferences using an evidence accumulation modeling framework where the salient option is given an initial starting point boost or more attention is paid to comparisons with the salient option during deliberation.

Experimental Design

Participants were recruited using Cloud Research On MTurk.

- N=100 people (96 completed).
- Each Trial had 3 Options with 2 attributes.
- Salience was manipulated with **Color**.
- Complementary Colors were Selected and Randomized for Every Trial.

Each participant did a total of 235 trials

- 96 Attraction Trials – 4 Conditions: 24 trials
- 96 Dominant Trials – 4 Conditions: 24 trials
- 3 Practice Trials and 40 Distractor Trials.

Experimental methods and analysis was pre-registered. https://aspredicted.org/3x9hk.pdf

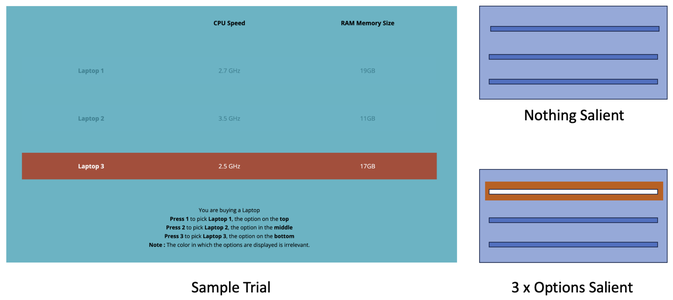


Figure 1. The left panel shows a sample trial. The right panel depicts the different conditions in the experiment.

Hypotheses

- **Hypothesis 1:** Salience creates an Initial Boost for the Preference for the Salient Option
- **Hypothesis 2:** Salience Boosts the Probability of Making Comparisons with the Salient Option

Behavioral Results

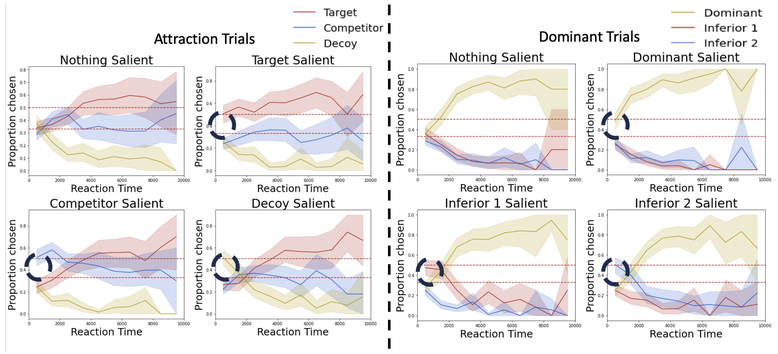


Figure 2. Reaction time and choice. In the all the panels, we observe an initial bias to pick the salient option.

Modeling Methods

To evaluate both hypotheses simultaneously, we employ the '**Full Model**'. For Hypothesis 1, we use the '**Initial Boost Only**' model. Hypothesis 2 is tested with the '**Comparison Boost Only**' model. These are all contrasted against a baseline model that does not incorporate either of these processes.

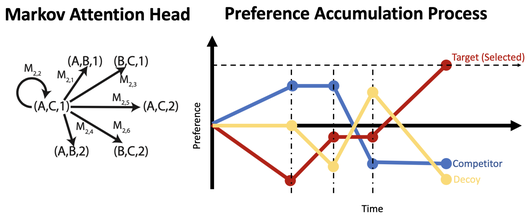


Figure 3. The comparison sampling modeling framework [2] has two components (i) Markov attention process that determines which alternatives and comparisons are being made at each moment in time and (ii) Preference Accumulation that integrates these comparisons until the threshold is crossed.

Model Comparison

	Model	Mean DIC
1	Base	670.7
2	**Initial Boost only**	**635.2**
3	**Comparison Boost only**	**659.2**
4	Full	635.3

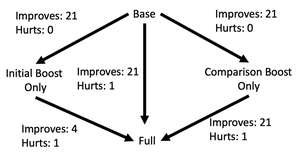
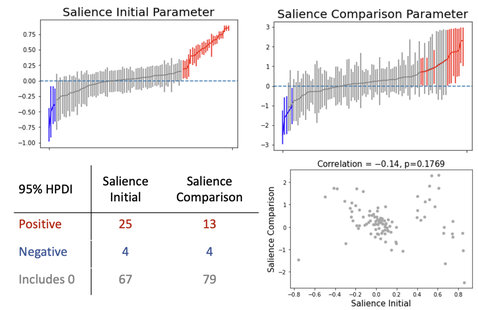


Figure 4. In the left panel, we show the mean Deviance Information Criterion. In the right panel, we show a nested model comparison.

Model Fitting Results



95% HPDI	Salience Initial	Salience Comparison
Positive	25	13
Negative	4	4
Includes 0	67	79

Figure 5. In the top panel, we show the Bayesian Fits for the Full Model. Specifically, we look at the Salience Initial Parameter (Hypothesis 1) and the Salience Comparison Parameter (Hypothesis 2). In the bottom left panel, we make inferences at the individual level using the Highest Posterior Density Interval. In the bottom right panel, we show the correlation between the two parameters.

Conclusions

- Examined two mechanisms for how salience impacts choices using the comparison sampling modeling framework.
- We observed large individual differences
- For many individuals, there was no observable impact of salience.
- For some individuals, there was evidence of salience impacting initial bias.

Future Directions

- Individual Difference Measure Correlates.
- Dynamics Manipulations: Speeded Decision Making
- Decision Environment Manipulations
- Visual Attention with Eye Tracking

Acknowledgments

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References

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[2] Jennifer Trueblood, Yanjun Liu, Matthew Murrow, William Hayes, and William Holmes. Attentional dynamics explain the elusive nature of context effects. 2022.

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